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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/093,291 06/08/98 VAN BUSKIRK F ATMI-272

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EXAMINER

OLSEN, A

ART UNIT	PAPER NUMBER
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1746

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DATE MAILED: 04/12/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/093,291

Applicant(s)
Van Buskirk et al.

Examiner
Allan Olsen

Group Art Unit
1746



☒ Responsive to communication(s) filed on Jan 10, 2000

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-56 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-56 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Information Disclosure Statement

1. The IDS submitted 9/10/98 refers to the related application 08/975,366. This file is unavailable to the examiner and therefore, has not been considered.

Specification

2. In view of the amendment filed 1/10/2000 the objection to the disclosure is hereby withdrawn.

Claim Objections

3. The objections to claims 21, 25, 23, 27, 29-33, 43 and 44 are hereby withdrawn.

Withdrawal of Claim Rejections

4. In view of the amendment filed 1/10/2000 the rejection of claim 43 under 35 U.S.C. 112, second paragraph is hereby withdrawn.
5. In view of the amendment filed 1/10/2000 the rejections of claims 41, 43, 44, 46-50 under 35 U.S.C. 102 as being anticipated by Smith and the rejections of claims 42 and 45 under 35 U.S.C. 103 as being obvious over Smith are hereby withdrawn.
6. In view of the amendment filed 1/10/2000 the rejection of claims 41, 43, 44 and 46-50 as being anticipated by Smith is hereby withdrawn.

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Claim Rejections

7. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 23 and 27 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 23 and 27 pertain to contacting an Ir residue with an agent to assist in volatilizing and removing the residue. The specification teaches the use of agents such as CO, PF₃ or P(alkyl)₃ (i.e. classic Lewis base and π -backbonding ligands). Specifically, on page 11, there is a teaching that CO may be used to assist in the volatilization of Ir(X)₁₋₆ by forming Ir carbonyl compounds, Ir(CO)_y(X)₁₋₆. In this teaching the Ir(X)₁₋₆ is the product a reaction between an Ir residue and a reactive halide composition. The Ir(X)₁₋₆ is not an agent used for contacting the Ir to assist in volatilizing the residue.

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10. Claims 1, 7, 23, 24, 47, 49, 50 and 54 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

11. The phrase "an amount effective to remove the residue" in claim 1 is a relative phrase which renders the claim indefinite. The phrase "an amount effective to remove the residue" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

The amount that is deemed to be an effective amount would be dependant upon the amount of residue that is being removed. To completely remove the residue would require an amount greater than that needed to remove only some of the residue. Therefore, "an amount effective to remove the residue" is an undefined amount because the amount of residue being removed is not set forth by the claim.

12. The phrase "in an amount and for a time sufficient to remove the residue" in claim 54 is a relative phrase which renders the claim indefinite. The phrase "in an amount and for a time sufficient to remove the residue" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

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The amount and time that is deemed to be an amount sufficient to remove the residue would be dependant upon the amount of residue that is being removed. To completely remove the residue would require greater amounts of reactive halide composition and/or a greater amount of time than the would be needed to remove only some of the residue. Therefore, "in an amount and for a time sufficient to remove the residue" is amount of reactant and the amount of time are undefined because the amount of residue being removed is not set forth by the claim.

13. Claim 7 recites the limitation "and the each fill of the cleaning gas". This limitation is confusing because there has never been any indication that there is more than one filling operation.

14. Claim 23 recites the limitation "the agent comprises an iridium halide species". There is insufficient antecedent basis for this limitation in the claim. Claim 22 upon which claim 23 depends recites the agent is selected from a group consisting of carbon monoxide, trifluorophosphine and trialkylphosphines. Claim 23 should read --...wherein the agent further comprises...--.

15. Claim 24 recites "The method according to claim 19 wherein the cleaning gas...". There is insufficient antecedent basis for "the cleaning gas".

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16. Claim 47 recites the limitation "the cleaning gas". There is insufficient antecedent basis for this limitation in the claim.

17. Claim 50 recites the limitation "the gas phase reactive halide composition". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

18. Claims 1, 3-6, 8, 9, 13-18, 28-33 and 54 are rejected under 35 U.S.C. 102(e) as being anticipated by US 5,814,238 (Ashby et al., hereafter, Ashby).

☞ Claims 1, 3, 6, 15-18 and 54: Ashby teaches a method for removing contaminants of Pt, Pd, Ir and Rh from the surface of a wafer that uses a gas phase reactive halide composition. Ashby teaches the use of SF₆ as a component of the reactive halide composition. See: col. 1, lines 10-16 and col. 4, lines 4,5 and 62.

☞ Claims 4, 13, 14, 30-32: SiF_x species, including radicals, are inherently present in the method of Ashby, as are the hexafluorides of the noble metal. Ashby teaches the removal of metal/metal silicides in a fluorine plasma environment which would inherently produce these claimed species (col. 7, line 45-67).

☞ Claim 5: Ashby teaches operating at a temperature of up to about 200°C (col. 7, line 18).

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☞ Claims 8, 9: Ashby teaches a flow rate of 11 sccm and pressure of 125 mTorr (col. 8, lines 3,4).

☞ Claim 28, 29, 33: Ashby teaches the use of a cleaning enhancement agent/Lewis base (e.g. PF_3 , CO , PR_3), an inert gas and a plasma (abstract; col. 3, line 26 - col. 5, line 8).

19. Claims 1-4, 6, 8, 12-15, 28, 30, 31, 33 and 54 are rejected under 35 U.S.C. 102(e) as being anticipated by US 5,911,887 (Smith et al., hereafter, Smith).

☞ Claims 1, 6, 15, 54: Smith teaches a method that uses a gas phase reactive halide composition for removing Pt from a wafer's surface (col. 1, lines 58-65).

☞ Claim 2: As a reactive halide Smith teaches the use of XeF_2 (col. 5, line 60).

☞ Claim 3: As a reactive halide Smith teaches the use of SF_6 (col. 5, line 60).

☞ Claims 4, 12-14, 30-32: PtF_6 and SiF_x and SiF_x radicals are inherently present in the method of Smith. Smith teaches removing Pt when silicon is present on the wafer. Reactions of both Si and Pt between fluorine atoms generated from XeF_2 , or between species of a fluorine plasma environment, would lead to the claimed species (col 3, ln 13-18; col. 5, ln 38-47).

☞ Claims 28, 33: Smith teaches the use of a cleaning enhancement agent/Lewis base (e.g. PF_3 , CO), an inert gas and a plasma (col. 5, lines 5, 58-60).

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20. Claims 1-7, 10, 11, 13, 14, 17, 19-42, 44, 45 and 51-56 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6,018,065 (Baum et al., hereinafter, "Baum").

The Baum disclosure incorporates by reference the allowed US application 08/966,796. Therefore, the disclosure of the allowed application 08/966,796 is considered to be contained within the Baum disclosure.

Baum teaches removing Iridium with a gaseous composition that includes XeF₂. Baum teaches the use of other reactive fluorine sources such as SF₆, SiF₄, Si₂F₆, SiF₂, SiF₃ in combination with XeF₂. Baum also teaches the use of CO as part agent to enhance volatility of the Ir. Baum teaches the use of reaction conditions such as pressure, temperature and time that coincide with the conditions of the instant claims. Baum's method is primarily directed to etching of Ir whereas the instant claims are directed to a method of "removing residue". The examiner noted that in the instant invention the residue is removed by etching. Furthermore, the method of Baum would inherently remove residue. For particularly relevant passages in '065 see col. 2, lines 52-65 and col. 4, line 59 - col.5, line 26. In 08/966,796 see: page 6, lines 4-15; page 7, lines 11-19; page 8- page 9; page 11, line 14- page 13, line 24; page 14, lines 4-26; page 15, lines 13-15.

Claim Rejections - 35 USC § 103

21. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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22. Claims 1, 8, 9, 41, 47, 48 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum.

Baum teaches the method of the instant claims as noted above.

Baum does not explicitly teach that gases including XeF_2 , SiF_2 and SiF_3 are continually flowed through the reactor. However Baum does teach the use of a plasma in conjunction with the method. It is well known in the art that plasma apparatus are typically operated under a dynamic vacuum condition with a constant flow of gases entering (and leaving) the chamber.

It would have been obvious for one skilled, using a plasma to carry out the method of Baum, to operate under a pressure of 50 mTorr to about 2 Torr and to use a constant flow of XeF_2 of between 1 sccm and 10,000 sccm because these are standard conditions that skilled artisans use for plasma methods.

23. Claims 1, 8, 12, 41, 43, 46-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum in view of Chang et al. in Proc. of SPIE, vol. 2641, pp 117-128 (1995), hereinafter, Chang.

As noted above Baum does not teach that gases including XeF_2 , SiF_2 and SiF_3 are continually flowed through the reactor. Also Baum does not teach the inclusion of silicon within the reaction chamber so that the XeF_2 can react with the silicon and form radicals of SiF_2 and SiF_3 .

Chang teaches that the continuous flowing method is easier and more convenient. Therefore it would have been obvious for one skilled in the art to use this method.

Chang also teaches that XeF_2 reacts with silicon to form SiF_x species.

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One skilled in the art would have been motivated to introduce silicon into the chamber because Chang teaches that this is a very convenient means of producing reactive species that Baum teaches are useful in the etching of Ir.

24. Claims 1, 7 and 34-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ashby ('238).

Ashby teaches a method of removing contamination from semiconductor wafers as described above. The method is very generic with regard to particular ways the method may be used. The reference broadly refers to electronic circuits, which generically embraces a capacitor

One skilled in the art would have been motivated to use Ashby's method to remove the impurities of the type described in claims 34-40 because, as pointed out by the applicant in pages 2-4 of the specification, it is well known that such impurities are present at the claimed stage of processing, and in the claimed form. Furthermore, it is well known and admitted that such impurities are very disadvantageous. Therefore, by applying Ashby's method for removing transition metal impurities from a wafer, one would eliminate or reduce problems, such as short circuiting, that are caused by such impurities.

The limitation of claim 7 pertains to the duration of the etching process. Process parameters such as time, flow rates, pressure, power or temperature are considered to be cause effective variables, the exact values of which may be optimized through routine experimentation, and as such are not patentable.

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"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ 233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

25. Claims 7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith ('887).

Claims 7 and 9 pertain process parameters that are considered to be cause effective variables, the exact values of which may be optimized through routine experimentation. Should the applicant contend that the claimed values are critical in obtaining a new and unexpected result, the applicant has the burden of proving such criticality. *In re Swenson et al.*, 30 C.C.P.A. (Patents) 809, 132 F.2d 1020, 56 USPQ 372 ; *In re Scherl*, 33 C.C.P.A. (Patents) 1193, 156 F.2d 72, 70 USPQ 204.

Claims 10 and 11 pertain obtaining the XeF₂ vapor from sublimation of XeF₂.

Smith does not teach the nature of the XeF₂ source .

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One skilled in the art would be motivated to obtain XeF_2 vapor through the sublimation of the solid because XeF_2 is a solid that very readily sublimates, therefore, this would be the most convenient and economical manner of obtaining the vapor.

Response to Arguments

26. Applicant's arguments filed 1/10/2000 have been fully considered but they are not persuasive.

Applicants state that the novelty of claim 1 is based upon the required presence of at least one of a specified group of halide compounds "in an amount effective to remove the residue".

Applicants have taken position that Ashby fails to teach this limitation of amended claim 1.

The examiner believes Ashby clearly teaches the utility of SF_6 in the removal of Pt, Pd, Rh, or Ir residues. Even though Ashby does not specifically teach using SF_6 "in an amount effective to remove the residue" the examiner is of the opinion that this limitation is inherent to the teaching of Ashby because the alternative (i.e. using an amount that is ineffective to remove the residue) is not consistent with that which is expected from a skilled artisan. The same reasoning applies to the limitation of claim 6, "for a time sufficient to effect removal."

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Conclusion

27. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is (703) 306-9075. The examiner can normally be reached on Monday through Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski, can be reached on (703) 308-4333. The fax phone number for this Group is (703) 305-5408.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen

April 7, 2000



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